

## lecture 4

Brad McNeney

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## Data management

# Data management overview

- ▶ After reading data into a data frame, we need to manage it:
  - ▶ print, view and edit data frames, add/delete variables
  - ▶ derive new variables from old
  - ▶ merge and reshape datasets
- ▶ There are many tools in “base” R.
- ▶ Recently the `dplyr` package has become popular for management of data frames.
  - ▶ Design goal is to make data management more intuitive
  - ▶ Will discuss `dplyr` alternatives where possible.

Print, view, edit

## `print()`, `View()` and `edit()`

- ▶ `print()` prints R objects
  - ▶ This function is “generic”, meaning that it will try to find the specific function to print specific objects (e.g., `print.data.frame`).
- ▶ `View()` launches a new window (or RStudio tab) to view a data frame and `edit()` launches a data editor.

# Access variables in a data frame

- ▶ Can use what we learned about subsetting:

```
testdf = data.frame(ID=1:3,age=c(8,11,14),height=c(52,63,70))  
testdf$ratio <- testdf$height/testdf$age
```

- ▶ or can use with()

```
testdf$ratio <- with(testdf,height/age)
```

- ▶ Notice how we can add a new variable to testdf by assignment.

## Using `attach()` to attach a data frame

- ▶ What `with()` is doing is (i) create a temporary environment, (ii) copy the variables in `testdf` into this environment, (iii) evaluate the expression `height/age` in this temporary environment and (iv) return the results.
- ▶ We can do this manually with `attach(testdf)` followed by the expression/assignment, and then use `detach("testdf")` to get rid of the temporary environment.
- ▶ However, the original data frame and its copy can get out of sync and cause confusion, or we might forget to `detach()`.
- ▶ Attaching data frames is generally frowned upon.

# Adding and deleting variables from a data frame

- ▶ We saw how \$ can be used to add variables to a data frame.
- ▶ Remove variables by setting to NULL

```
testdf$ratio <- NULL  
testdf
```

```
##   ID age height  
## 1   1   8     52  
## 2   2  11     63  
## 3   3  14     70
```

- ▶ To rename a variable, can add it under new name and remove old variable. Also see the `rename()` function in the `dplyr` package.



Derived variables

## Adding derived variables with transform()

- ▶ transform() together with an assignment can add and/or modify variables:

```
testdf <- transform(testdf, ID = c("E", "K", "H"),  
                      ratio = height/age)  
testdf
```

##	ID	age	height	ratio
## 1	E	8	52	6.500000
## 2	K	11	63	5.727273
## 3	H	14	70	5.000000

## Adding derived variables with within()

- ▶ `within()` is similar to `transform()` but allows us to use variables we create in the call:

```
testdf <- within(testdf, {  
  heightcm <- height*2.54 # now use new variable heightcm  
  ratiocm <- heightcm/age  
})  
testdf
```

##	ID	age	height	ratio	ratiocm	heightcm
## 1	E	8	52	6.500000	16.51000	132.08
## 2	K	11	63	5.727273	14.54727	160.02
## 3	H	14	70	5.000000	12.70000	177.80

## Adding derived variables with mutate()

- ▶ mutate() from the dplyr package is very similar to transform()
  - ▶ Being from dplyr suggests using the forward pipe %>% to chain multiple mutate()s

```
library(dplyr)
testdf %>%
  select(ID,age,height) %>%
  mutate(heightcm = height*2.54) %>%
  mutate(ratiocm = heightcm/age) -> testdf
testdf
```

##	ID	age	height	heightcm	ratiocm
## 1	E	8	52	132.08	16.51000
## 2	K	11	63	160.02	14.54727
## 3	H	14	70	177.80	12.70000

- ▶ Notice the use of -> to assign the results of our data manipulations.

# Creating and working with categorical variables

- ▶ We may want to
  - ▶ create categorical by binning a numeric
  - ▶ create categorical with logical conditions
  - ▶ recode categories

# Binning a numeric variable with cut()

- Creates a factor based on equal-width bins by default:

```
set.seed(1)
n <- 100
age <- sample(17:85,size=n,replace=TRUE)
agecat <- cut(age,breaks=5)
table(agecat)
```

```
## agecat
## (16.9,30.6] (30.6,44.2] (44.2,57.8] (57.8,71.4] (71.4,85.1]
##           15          23          18          26          18
```

## DIY bins with cut()

- Custom bins. Be careful not to exclude any data values.

```
agecat <- cut(age,breaks = c(17,30,40,50,60,70,80))  
agecat[age==17]
```

```
## [1] <NA>
```

```
## Levels: (17,30] (30,40] (40,50] (50,60] (60,70] (70,80]
```

```
agecat <- cut(age,breaks = c(15,30,40,50,60,70,80))  
table(agecat)
```

```
## agecat
```

```
## (15,30] (30,40] (40,50] (50,60] (60,70] (70,80]
```

```
##      15      16      19      9      20      17
```

# Create categorical from logical conditions

- Usual strategy is to initialize a vector to a baseline category and then use logical conditions to assign category of subsets.

```
group <- sample(c("A","B"),size=n,replace=TRUE)
catvar <- rep(1,n)
catvar[age<50 & group=="A"] <- 2
catvar[age<60 & group=="B"] <- 3
table(catvar)
```

```
## catvar
##  1  2  3
## 49 20 31
```



# Recoding variables

- For numeric or character categories use logical conditions.

```
catvar[catvar==3] <- 11 # 11 gets recycled
```

- For factors, remember that they are numeric with character labels, or levels
  - just change the levels

```
head(agecat)
```

```
## [1] (30,40] (40,50] (50,60] (70,80] (15,30] (70,80]  
## Levels: (15,30] (30,40] (40,50] (50,60] (60,70] (70,80]
```

```
levels(agecat)[1] <- "[17,30]"  
head(agecat)
```

```
## [1] (30,40] (40,50] (50,60] (70,80] [17,30] (70,80]  
## Levels: [17,30] (30,40] (40,50] (50,60] (60,70] (70,80]
```

## Using `recode()` and `recode_factor()` from `dplyr`

- Can recode multiple values at once and use with `%>%`

```
# Enclose numeric values in backticks
```

```
head(recode(catvar, `1`="pen", `2`="pineapple", `11`="apple"))
```

```
## [1] "apple"      "pineapple"  "pen"        "pen"        "apple"      "pen"
```

```
cut(age, breaks = c(15,30,40,50,60,70,80)) %>%
```

```
  recode_factor("(15,30]" = "[17,30]", "(70,80]" = "(70,100]") %>%
```

```
  head()
```

```
## [1] (30,40] (40,50] (50,60] (70,100] [17,30] (70,100]
```

```
## Levels: [17,30] (70,100] (30,40] (40,50] (50,60] (60,70]
```

- Notice how the order of the levels has changed.